

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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| In the Matter of: |) | | |
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| Amendment of the Commission's Rules with |) | | GN Docket No. 13-185 |
| Regard to Commercial Operations in the 1695- |) | | |
| 1710 MHz, 1755-1780 MHz, and 2155-2180 |) | | |
| MHz Bands |) | | |
| |) | | |
| Service Rules for Advanced Wireless Services |) | | WT Docket No. 07-195 |
| in the 2155-2175 MHz Band |) | | (Proceeding Terminated) |
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| Service Rules for Advanced Wireless Services |) | | WT Docket No. 04-356 |
| in the 1915-1920 MHz, 1995-2000 MHz, 2020- |) | | (Proceeding Terminated) |
| 2025 MHz, and 2175-2180 MHz Bands |) | | |
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| Applications for License and Authority to |) | | WT Docket No. 07-16 |
| Operate in the 2155-2175 MHz Band |) | | (Proceeding Terminated) |
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| Petitions for Forbearance Under 47 U.S.C. § |) | | WT Docket No. 07-30 |
| 160 |) | | (Proceeding Terminated) |
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COMMENTS OF MOTOROLA MOBILITY LLC

Motorola Mobility LLC ("Motorola Mobility") hereby submits the following comments in response to the Federal Communications Commission's ("Commission") Notice of Proposed Rulemaking on commercial operations in the 1695-1710 MHz, 1755-1780 MHz, 2020-2025 MHz, and 2155-2180 MHz spectrum bands.¹

I. INTRODUCTION

Motorola Mobility supports the Commission's ongoing efforts to make spectrum available to address the ever-growing demand for wireless broadband services, consistent with

¹ See Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands, *et al.*, GN Docket No. 13-185, *Notice of Proposed Rulemaking*, FCC 13-102 (rel. July 23, 2013) ("Notice").

the policies articulated in the National Broadband Plan, the Middle Class Tax Relief and Job Creation Act of 2012 (“Spectrum Act”), and by the President.² As President Obama correctly noted in a June 14, 2013, Presidential Memorandum “[e]xpanding the availability of spectrum for innovative and flexible commercial uses, including for broadband services, will further promote our Nation’s economic development by providing citizens and businesses with greater speed and availability of coverage, encourage further development of cutting-edge wireless technologies, applications, and services, and help reduce usage charges for households and businesses.”³

The proposals in the Notice would add up to 70 megahertz of licensed mobile broadband spectrum to the nation’s spectrum inventory. Although a very important step, this allocation should only be one of many that the Commission takes to further address the exploding demand for broadband services. The Commission must continue to pursue a balanced approach to spectrum policy that accommodates the vital needs for both licensed and unlicensed services and devices.⁴ As the Commission moves quickly to finalize use of the AWS-3 spectrum, it should continue driving forward with efforts to provide additional spectrum for unlicensed uses or other alternative business models.⁵

² See Federal Communications Commission, Connecting America: The National Broadband Plan at Chapter 5 available at <http://www.broadband.gov>; Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156 (2012) (“Spectrum Act”); Presidential Memorandum: Expanding America's Leadership in Wireless Innovation (June 14, 2013) available at <http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovation> (“Wireless Innovation Memorandum”).

³ See Wireless Innovation Memorandum.

⁴ See also Comments of Motorola Mobility LLC at 3-6, GN Docket No. 12-268 (filed Jan. 25, 2013).

⁵ See, e.g., Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, ET Docket No. 13-49, *Notice of*

In crafting licensing and service rules for the AWS-3 spectrum, the Commission should consider how such rules will affect device design, operational issues, the economics of manufacturing and network deployment, and any other matters that would affect the operation and cost of ownership—and therefore the commercial attractiveness—of devices designed to operate on these new spectrum bands. This is best accomplished by conforming the AWS-3 rules with those used in similar commercial mobile bands to the maximum extent possible.

II. THE AWS-3 BANDS WILL BE AN IMPORTANT ADDITION TO THE NATION’S MOBILE SPECTRUM INVENTORY.

The Commission should move forward promptly to make the 1695-1710 MHz, 1755-1780 MHz, 2020-2025 MHz, and 2155-2180 MHz (collectively, “AWS-3”) spectrum bands available for commercial mobile use. In addition to adding 70 megahertz to the nation’s mobile spectrum inventory, the AWS-3 bands will be particularly useful because of their adjacency to other mobile broadband allocations. Each segment of the AWS-3 band is adjacent to one or more existing commercial allocations, facilitating possible efficiencies in terms of device and network design. Indeed, once allocated to commercial mobile use, the AWS-3 bands will create contiguous mobile bands from 1695 MHz to 1780 MHz (85 megahertz) and 2110 MHz to 2200 MHz (90 megahertz). These wide, uniform allocations will allow carriers to effectively integrate the spectrum into their existing networks, and could also facilitate the development and deployment of wider bandwidth applications, such as those that will be available in future evolutions of today’s 4G mobile broadband technologies.⁶

Proposed Rulemaking, 28 FCC Rcd 1769 (2013); Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Notice of Proposed Rulemaking*, 27 FCC Rcd 15594 (2012)

⁶ See, e.g., International Telecommunication Union Report ITU-R M.2134, Requirements Related to Technical Performance for IMT-Advanced Radio Interface(s), at 5 Section 4.3 (2008)

While each of the AWS-3 bands will be important additions, and the Commission should move forward with all of them, the centerpiece of the Notice is the potential pairing of the 1755-1780 MHz and 2155-2180 MHz band segments. Because of its international harmonization and adjacency to the current AWS-1 band, Motorola Mobility and others in the industry have long urged the Commission to make this particular spectrum pairing available,⁷ and it should be the focus of the Commission's efforts in this proceeding.

Internationally, the 1755-1780 and 2155-2180 MHz bands are allocated for mobile services and have been designated by the International Telecommunication Union for IMT-2000 and IMT-Advanced.⁸ The 1755-1770 MHz and 2155-2170 MHz segments of these two bands are already defined as a 3GPP FDD band class in the standards for LTE services.⁹

Harmonization with international band plans and standards could allow for the use of devices and components that have been developed and manufactured for a global market, potentially making devices more useful to consumers and creating economies of scale that drive down the cost of user equipment and shorten development cycles.

The 1755-1780 / 2155-2180 MHz pairing would be a natural extension of the 1710-1755 / 2110-2155 MHz AWS-1 band, which is becoming a major platform for LTE and other mobile

(IMT Advanced Technologies “shall support a scalable bandwidth up to and including 40 MHz,” and encouraging operation in bandwidths up to 100 megahertz).

⁷ See, e.g., Comments of Motorola, Inc. at 6-7, ET Docket No. 10-123 (filed June 28, 2010) (“Motorola 1675-1710 MHz Comments”); Comments of CTIA—The Wireless Association at 8-10, ET Docket No. 10-142 (filed July 8, 2011).

⁸ See 47 C.F.R. § 2.106. See also, International Telecommunication Union Recommendation ITU R M.1036 Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)” (Geneva, 2012).

⁹ See 3GPP TS 36.104 at Table 5.5-1, “LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception” (identifying 1710-1770 / 2110-2170 MHz as Band 10).

broadband technologies. There would be significant device design benefits to pursuing this pairing. Because the 1755-1780 / 2155-2180 MHz pairing is symmetrical to the AWS-1 band and has the same duplex spacing, this band could be supported by existing duplexers. Additionally, existing power amplifiers for devices are designed to operate across the 1710-1980 MHz band meaning that the 1755-1780 MHz band could be included with little complication. These efficiencies mean that 1755-1780 / 2155-2180 MHz capabilities likely could be built into devices with minimal additional cost and without a significant impact on battery life, heat production, or other performance characteristics.¹⁰

III. THE AWS-3 SERVICE RULES SHOULD PROMOTE ROBUST MOBILE BROADBAND DEPLOYMENT.

To maximize the benefits of the wide new mobile spectrum allocations being made available in this proceeding, the Commission should adopt service rules that support robust deployment and easy integration into existing mobile broadband networks. To that end, the AWS-3 service rules should be based, to the greatest extent possible, on those applied to the AWS-1 and AWS-4 bands, and on international standards. In particular, the technical rules regarding power limits, out-of-band emissions (“OOBE”), and antenna height should be consistent with those adopted in the neighboring bands.

Out-of-band Emissions. The Commission’s proposals for AWS-3 service rules largely are consistent with the AWS-1 and AWS-4 rules. As the Commission notes, “experience indicates that the [AWS-1] requirements have facilitated good service while minimizing undesirable interference,”¹¹ and therefore the Commission should adopt most of these proposals. Specifically, the Commission should apply the OOBE attenuation factor of $43 + 10 \log (P)$ dB to

¹⁰ Cf. Motorola 1675-1710 MHz Comments at 5 (discussing challenges with a non-standard pairing of 1675-1710 MHz and 2155-2180 MHz).

¹¹ Notice at ¶ 85.

AWS-3 operations in all bands, as proposed in the Notice.¹² This is a standard attenuation factor commonly used in commercial mobile devices that has been demonstrated to adequately protect adjacent services from harmful interference. Applying this same factor—which is also applied to AWS-1 and AWS-4 operations—to AWS-3 will reduce cost and complexity in device development and will promote smooth integration of AWS-3 into the Commission’s overall commercial band plan.

Antenna Height. Similarly, the Commission should also apply to AWS-3 the flexible antenna height rules applicable to AWS-1, as proposed in the Notice.¹³ There is no need for the Commission to set special base station height restrictions for the AWS-3 band. As the Commission notes, Part 27 services are already subject to Section 27.56, prohibiting antenna heights that would be hazardous to aircraft.¹⁴ Additionally, antenna heights are effectively limited by interference protection criteria and the need for spectral reuse. Flexible antenna height rules are appropriate here and will further facilitate the integration of AWS-3 into existing networks.

Power Limits. The Commission should also proceed with its proposals to apply the AWS-1 and AWS-4 base station power limits to AWS-3 base stations in the 2155-2180 MHz band segment, and to apply the AWS-4 mobile power limits to mobile and portable devices operating in the 2020-2025 MHz band segment.¹⁵ The Commission should not, however, adopt the non-conforming 100 mW (20 dBm) EIRP limit proposed for AWS-3 mobile devices in the

¹² *Id.*, ¶¶ 86-94.

¹³ *Id.*, ¶ 96.

¹⁴ 47 C.F.R. § 27.56.

¹⁵ Notice at ¶¶ 100, 103.

1695-1710 MHz and 1755-1780 MHz band segments.¹⁶ The 20 dBm power limit would add complexity and hinder device operations unnecessarily.

The Commission proposes to adopt the 20 dBm EIRP limit based on the analysis of the Commerce Spectrum Management Advisory Committee (“CSMAC”), which considered device EIRPs ranging from -40 dBm to +20 dBm.¹⁷ However, the simulation parameters in the CSMAC study were chosen to model a harsh interference environment and not necessarily to set maximum mobile transmit power limits in the regulatory environment.

CSMAC modeled the top 100 cities across the US with an inner radius of 30 km assuming suburban deployment and an outer radius of 100 km for a rural deployment. This resulted in a model of a 10 megahertz LTE network consisting of 170,000 base stations and 3 million simultaneous transmitting devices across the US.¹⁸ CSMAC Working Group 3 acknowledged that this conservative modeling “use[d] some assumptions which are expected to over-estimate the level of interference.”¹⁹ Moreover, fifteen members of the CSMAC issued a separate statement concurring with the release of the reports but characterizing the analysis as “both conservative and limited” and cautioning that “many of the current analysis results do not represent the real-world interference environment between Federal and commercial users.”²⁰

¹⁶ *Id.*, ¶¶ 102-103.

¹⁷ *Id.*, ¶ 102 (citing, CSMAC Working Group 1 Final Report, App. 3 available at http://www.ntia.doc.gov/files/ntia/publications/wg1_report_07232013.pdf).

¹⁸ See CSMAC Working Group 3 Final Report, Section 4.2.6.2 available at http://www.ntia.doc.gov/files/ntia/Working_Group_3_Final.pdf.

¹⁹ See *id.*, 157.

²⁰ See Separate Statement Concerning Working Group Reports For the 1755-1850 MHz Band, http://www.ntia.doc.gov/files/ntia/publications/csmac_separate_statement-aug_29_rev2.pdf (Aug. 29, 2013).

It is Motorola Mobility's understanding that CSMAC's use of the 20 dBm EIRP upper limit was based on the 23 dBm +/- 2 dBm transmitter power output ("TPO") limit set by the LTE standard, less 3 dB in assumed losses from issues such as negative antenna gain.²¹ In the real world, however, actual losses will be greater, which justifies a higher power limit in the Commission's rules. For example, losses due to RF absorption and reflection by the human body are nominally considered to be 8 dB.²² Additional loss will be caused by terrain, foliage, buildings, and various other obstructions. Automatic power control also plays an important role; indeed, even with a 23 dBm +/- 2 dBm TPO limit, simulations conducted by 3GPP show that the average transmit power across all devices in a mobile network is below 1 dBm and that 95 percent of all devices transmit with a power below 7 dBm.²³

These factors obviate the need for setting the AWS-3 power limit so low. Considering a higher value for the maximum EIRP would not change the conclusions of the CSMAC simulation study as the interference resulting from a real world scenario would be less than the interference levels used by the various CSMAC working groups. The accumulative interference generated by mobile devices will be at lower levels than assumed in the CSMAC simulation, as the assumed number of devices in operation at the same time will be much lower in a real world scenario and also because the devices will operate at minimum transmit power levels necessary to maintain service in order to extend battery life, reduce heat generation, and enhance overall system performance.

²¹ See 3GPP TS 36.101, Table 6.2.2-1, "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

²² See R4 080710, Annex A, "TS36.101: TP for UE Spurious emission limits", Motorola 3GPP TSG RAN WG4 (Radio) Meeting #46bis, Shenzhen, China, 2008.

²³ See 3GPP TR 36.942, Table 9.3, "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Frequency (RF) system scenarios".

Adopting the proposed 20 dBm EIRP limit could undermine the successful deployment of the AWS-3 band. Current devices and networks are designed and deployed in conformity with the 3GPP standards. AWS-3 devices required to abide by a non-standard power limit may have increased difficulty sustaining communications at the edge of service areas, which could force a network operator to decide between making costly network modifications or deploying AWS-3 devices with limited utility in existing network topologies.

For these reasons, the Commission should therefore reject its proposal to limit AWS-3 devices to 20 dBm EIRP and should instead apply the AWS-1 power limit to these devices, which technically permits mobile operations of up to 1 watt EIRP. The AWS-1 power limit would therefore accommodate the 23 dBm +/- 2 dBm TPO limit of the LTE standard, allowing for the use of commercially standard devices while still ensuring necessary protection to federal incumbents consistent with the findings of the CSMAC reports. Should the Commission believe there is a need for additional protection, it could model the AWS-3 rules on the AWS-1 regime, which sets separate coordination distances for devices that operate above 20 dBm EIRP and those that operate at or below 20 dBm EIRP.²⁴ At a minimum, if the Commission perceives the need to limit the AWS-3 mobile device EIRP to 20 dBm, the restriction should only apply in the areas near the established protection zones, and not on a nationwide basis. Such a local restriction could be implemented through network signaling and power control.

IV. CONCLUSION

Motorola Mobility supports the Commission's efforts to expand the availability of wireless broadband spectrum. Through the Notice, the Commission can add up to 70 megahertz of licensed mobile broadband spectrum to the nation's spectrum inventory. In doing so, the

²⁴ See 47 C.F.R. § 27.1134.

Commission should ensure that the licensing, band plan, and service rules are designed to promote efficient integration of the spectrum into commercial networks and devices, and to support robust nationwide deployment. To the extent possible, the Commission should base the AWS-3 rules on those applied to the AWS-1 band and on internationally-recognized industry standards.

Respectfully submitted,

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